January 2003 Unit 2

1)a) i) Description of asymmetry of electron/charge cloud hence attractive forces   1 mark

   Between neighbouring induced dipoles

   ii) NCl_3 / chlorine because more electrons   1 mark

   iii) NF3 because F more electronegative (than Cl)   1 mark

   iv) Van der Waals forces more significant/greater than permanent dipole-dipole
        interactions.   1 mark

b) i) N(g) + 3F(g) in top right-hand box

    $\frac{1}{2}N_2(g)$ + $\frac{1}{2}F_2(g)$ in lower box   1 mark

   ii)
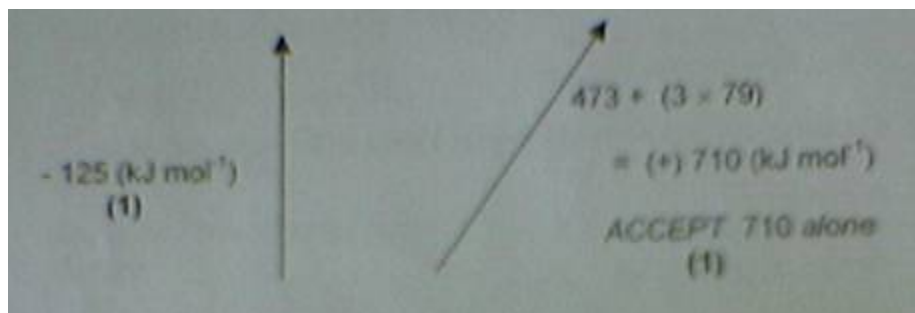
   Arrows in correct directions and labelled with correct data   2 marks

   iii) ΔH for [NF3(g)] □ N(g) + 3F(g) = 710 – (-125) = (+) 835 (KJ mol)

   E (N-F) = 835 = (+) 278 KJ mol
        3

   Penalise 4 or more SF

   Penalise incorrect units

2)a) i) Insert hot glass rod/(nichrome) wire into of gas/heat over Bunsen flame

   ii) Violet/purple vapour/gas/fumes

OR Black/brown-black/grey solid

b)   i)   Forward and reverse reactions occur at the same rate   (1)
              so there is no change in the proportions of the reactants and products
      (1)

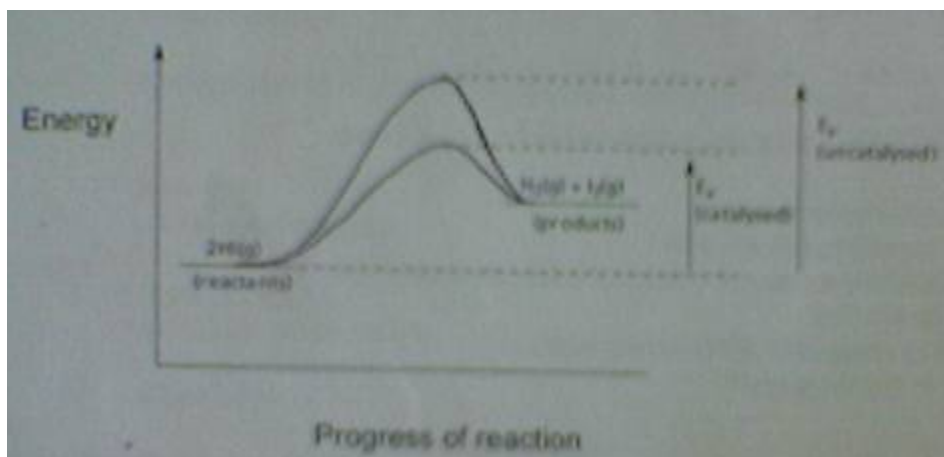   ii)   Proportions of HI expected to become smaller   (1)

              because reaction will respond to temperature increase by shifting in the
              endothermic direction
                    (1)

      ii)   No change expected because catalysts affect only **rate** at which equilibrium is
              attained

c)

              Products at higher energy level than reactants

              Line going up from reactants to peak (corresponding to transition state) then down
              to products

              Second line with lower peak representing the catalysed reaction

              Activation energies of uncatalysed and catalysed reactions correctly marked

3)a) i)   Ticks in Cl_2/KBr and Cl_2/KI boxes

      ii)   Solution/it becomes darker/ turns brown/orange/yellow
              OR black ppt

      iii) $Br_2 + 2I^- \rightleftharpoons I_2 + 2Br^-$

iv)   Test for bromide ions: add silver nitrate (solution)   (1)

                              pale yellow/cream/off-white/ivory ppt   (1)

OR

Test for iodine: add starch (solution)   (1)   OR   Hydrocarbon solvent
(1)

                       Blue-black colour   (1)   Purple/pink upper layer   (1)

Colour must be consistent with reagent

b)   i)   Cr/chromium and I/iodine identified   (1)
                 Cr, initially +6 finally +3   (1)
                 I, initially -1 finally 0   (1)

    ii) $Cr_2O_7^{2-} + 14H^+ + 6I^- \square\ 2Cr^{3+} + + 3I_2 + 7H_2O$

c)   i)   Bromine is toxic/poisonous/corrosive/causes burns

    ii)   May leave harmful residues   (1)
                 Harmful vapour could escape   (1)
                 Total opposition to use of chemical pesticides as posing a
                 general health risk   (1)
                 Damages/harms ozone layer   (1)
                 Build up in food chains   (1)

4)a)   It is a mixture/not a single compound

b)   i)   2,4-dimethylpentane

    ii) C_7H_{16}

    iii)   More volatile/lower boiling point/vapourises more/
                higher octane number

    iv)   Heat/high temperature/≥200   (1)
                 Silica/alumina (catalyst)   (1)

    v)   Diagram should show:

               Test tube containing paraffin absorbent-   (1)
               Absorbent can be just shown on the diagram

Aluminium oxide catalyst (1)

Heat catalyst (1)

Recognition of collection of gas over water/gs syringe (1)

Penalties
-1 for poor diagram

c) i) $(CH_3)_2C = CH_2$
ACCEPT $(CH_3)_2CCH_2$

ii) Elimination

iii) Potassium hydroxide / KOH / NaOH (1)
Ethanoic / alcoholic solution + heat / reflux (1)

5)a) i) Viscosity / it affects ease / extent of penetration

ii) High viscosity caused by strong intermolecular forces

b) The portion / fraction of pores connected to the surface of the material / accessible to consolidant

c) Diagram shows H bond between any -OH group in cellulose and an ether oxygen in
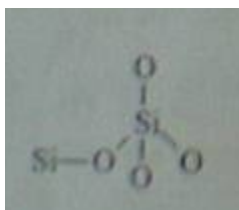PEG

d) Molar mass of each repeat unit $(-CH_2-O-CH_2-)$ =44
(1)
so number of repeat units per molecule = 1500 = 34 (nearest whole number)
(1)
44

e)

Must show a Si atom joined, tetrahedrally, to 4 O
atoms and one of the O atoms must be
joined to two Si atoms

f)   Examiners will consider each answer for (i) key points and (ii) quality of written
communication. Candidates should have recounted their word total at the end of
their answer, and this should be checked.
Up to 125 words no penalty
128-135 words **-1**
136-145 words **-2**
146-155 words **-3**
And at a rate of -1 penalty for every 5 words in excess thereafter up to a maximum
penalty equal to the number of key points included in the answer
Formulae count as name in the word count
Eg Polyethylene glycol = 2 words
         PEG = 1 word
         SiOC = 1 word
         SiOSi = 1 word
Note that words appearing in the title to the summary do not count in the word
total.
BUT subheadings **do** count

Marking for Key Points

One mark awarded for every key point clearly identified in an answer, up to a
maximum of 6 marks.

List of key points these may be a **different** order and need not be expressed in the
writing below provided that the sense of each point is conveyed.

Key Points:

1.   Stone objects deteriorate + reason(s)

2.   consolidants are used to restore (structural strength

3.   consolidant must penetrate the object **and** bend it together

4.   has to be applied as a liquid / solution which then solidifies

5.   Organosilane consolidant applied as a monomer

6.   which polymerises **within the object**

7. Polymer formed resembles silica/carbon dioxide which is **very stable**

8. Polymer shrinks back on to poer walls and binds the object together